TABULATION OF STATISTICS.

In *The School of Mines Quarterly* (Columbia College), for April, 1889, there is published an article entitled "An Electric Tabulating System," by H. Hollerith. An abstract of a portion of it is reprinted.

Few who have not come directly in contact with a census office can form an adequate idea of the labor involved in the compilation of a census of 50,000,000 persons, as was the case in the last census, or of over 62,000,000, as will be the case in the census to be taken in June, 1890. The fact, however, that Congress, at its last session, in "An Act to provide for the taking of the eleventh and subsequent censuses," fixes the maximum cost of the next or eleventh census, exclusive of printing and engraving, at $6,400,000, will perhaps impress one with some idea of the magnitude of such an undertaking.

Although our population is constantly increasing, still, up to the present time, substantially the original method of compilation has been employed, — that of making tally-marks in small squares and then adding and counting such tally-marks.

The work of a census can be divided into two main branches,— that of enumeration and that of compilation or tabulation. Referring to the records of the tenth census, we find the cost of the enumeration to have been $2,095,563.32, and the expenses of the office of the Superintendent of the Tenth Census, at Washington, $2,385,999.50. If the same methods of compilation are to be employed in the next census, the *per capita* cost of compilation would, of course, remain substantially the same, so that, allowing for the increased population, the expenses of this portion of the work would amount to $3,101,799.67. If, however, the data enumerated at the next census is compiled with that fullness and completeness which it deserves, and which it ought to receive, this expense would far exceed the above amount.

The population schedules of the tenth census contained the following inquiries, the replies to which were capable of statistical treatment: Race; Sex; Age; Relationship to head of family; Civil or conjugal condition; Whether married during the census year.

Occupation; Number of months unemployed; Whether sick or otherwise temporarily disabled; What was the sickness or disability? Whether blind, deaf and dumb, idiotic, insane, maimed, crippled, bed-

ridden, or otherwise disabled; Whether the person attended school during the census year; Cannot read; Cannot write; Place of birth; Place of birth of father; Place of birth of mother.

Many of the facts enumerated in the tenth census were not compiled at all, or, if compiled, were treated in so simple and elementary a manner as to leave much to be desired. Thus, for example, it is today impossible to obtain the slightest reliable statistical information regarding the conjugal conditions of our people, though the complete data regarding this is locked up in the returns of the enumeration of the tenth census.

To know simply the number of single, married, widowed, and divorced persons among our people would be of great value; still it would be of very much greater value to have the same information in combination with age, with sex, with race, with nativity, with occupation, or with various sub-combinations with these data.

If the data regarding the relationship of each person to the head of the family were properly compiled, in combination with various other data, a vast amount of valuable information would be obtained. So, again, if the number of months unemployed were properly enumerated and compiled with reference to age, to occupation, etc., much information might be obtained of great value to the student of the economic problems affecting our wage-earners.

Another illustration will be given. We have, in a census, besides the data relating to our living population, records regarding the deaths during the previous year. In both cases we have the information regarding age and occupation. If the living population were tabulated by combinations of age and occupation, and likewise the deaths by ages and occupations, we would then have data from which some reliable inferences might be drawn regarding the effects of various occupations upon length of life. It might even be possible to construct life tables for the various occupations, as we do now for the different states and cities. Such information would be of service in relation to life insurance and other problems. Again, it would point out any needed reforms regarding the sanitary conditions and surroundings of any occupation. This is a field of statistical investigation which is as yet almost wholly unexplored.

If at the eleventh census no material improvements are adopted in the methods of tabulation, it will probably be found impossible to

accomplish more than that at the tenth census on account of the time and expense involved.

In place of the traditional methods of tabulation it is suggested that the work be done, so far as possible, by mechanical means. In order to accomplish this, the records must be put in such shape that a machine could read them. This is most readily done by punching holes in cards or strips of paper, which perforations can then be used to control circuits through electro-magnets operating counters, or sorting mechanism, or both combined.

Record-cards of suitable size are used, the surfaces of which are divided into quarter-inch squares, each square being assigned a particular value or designation. If, for example, a record of sex is to be made, two squares, designated, respectively, M and F, are used, and, according as the record relates to a male or female, the corresponding square is punched. In similar manner other data, such as relate to conjugal condition, to illiteracy, etc., are recorded. It is often found, however, that the data must be recorded with such detail of specification that it would be impracticable to use a separate space for each specification. In such cases recourse is had to combinations of two or more holes to designate each specification.

These punched record-cards are then treated in certain electrical apparatus, which consists essentially of a press or circuit-closing device, a series of electro-mechanical counters, and an electrical sorting mechanism.

The press is provided with a number of projecting spring-actuated contact-points, so arranged that if a card is placed in the press circuits will be closed through the punch holes operating the corresponding counters or sorting mechanism. The counters can be so connected or reconnected that any given counter will count any desired item or combination or group of items. The sorting mechanism is so arranged that, as the cards leave the press, they are automatically assorted according to any desired series of items, combinations or groups of items.

It is, of course, apparent that the number of items or combinations, which can be counted at any one time, is limited only by the number of counters, while at the same time the cards are sorted according to any desired set of statistical facts.

In a census the cards, as they come from the punching machines, would, of course, be arranged according to enumeration districts.

Each district could then be run through the press, and such facts as it is desired to know in relation to this unit of area, could be counted on the counters, while the cards are at the same time assorted according to some other set of facts, arranging them in convenient form for further tabulations. In this manner, by the arrangement of a judicious "scheme," it will be found that a most elaborate compilation may be effected with but a few handlings of the cards.

CONVENTION OF COMMISSIONERS OF BUREAUS OF STATISTICS OF LABOR.

Through the courtesy of Hon. Horace G. Wadlin the following condensed report of the proceedings of the recent Convention of the Commissioners of Bureaus of Labor Statistics has been furnished to the American Statistical Association. Later on the proceedings in full will be published by the Convention, and, until the limited edition is exhausted, may be obtained upon request of either of the Bureaus.

The Seventh Annual Convention of Chiefs and Commissioners of Bureaus of Statistics of Labor in the United States met in the Senate Chamber at the State Capitol, Hartford, Conn., Tuesday, June 25th, at two o'clock, the President, Carroll D. Wright, of the Department of Labor, Washington, D. C., presiding.

The following Commissioners were present: E. R. Hutchins, of Iowa (Secretary of the Convention); S. W. Matthews, Maine; Horace G. Wadlin, Massachusetts; J. B. Bowditch, Rhode Island; S. M. Hotchkiss, Connecticut; Edward J. Keene (Deputy Commissioner), New York; James Bishop, New Jersey; A. S. Bolles, Pennsylvania; H. M. Stark, Wisconsin; A. H. Heath, Michigan; John S. Lord, Illinois; John Lamb, Minnesota; Lee Meriwether, Missouri; John Jenkins, Nebraska; and F. J. Betton, Kansas.

In opening the Convention the President, Col. Wright, congratulated the members upon the generosity of the state in permitting them to use the Senate Chamber.